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| 09/844,679      | 04/30/2001  | Teruichi Watanabe    | Q64172              | 8978             |

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|                       |              |
|-----------------------|--------------|
| EXAMINER              |              |
| YAMNITZKY, MARIE ROSE |              |
| ART UNIT              | PAPER NUMBER |
| 1774                  | 5            |

DATE MAILED: 09/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AS5

**Office Action Summary**

Application No.

09/844,679

Applicant(s)

WATANABE ET AL.

Examiner

Marie R. Yamnitzky

Art Unit

1774

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 April 2001 and 29 August 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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1. The examiner acknowledges receipt of five (5) sheets of formal drawings filed 08/29/01.

2. The disclosure is objected to because of the following informalities:

The Tsutsui et al. article referenced on page 2 includes the notation "in press, pp. ?-?".

The disclosure consistently uses the term "carbasol" and variations thereof to refer to compounds comprising at least one "carbazole" moiety. The examiner has looked in two chemical dictionaries and does not find terms such as "carbasol", "dicarbasol" and "carbasolyl" to be recognized alternatives for the terms "carbazole", "dicarbazole" and "carbazolyl", respectively. (If applicants have a reference showing otherwise, they are requested to provide a copy to the Office in response to this action.)

Appropriate correction is required.

3. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Based on the formulae in the specification, the terms "carbasol", "dicarbasol" and "carbasolyl" as recited in one or more of claims 1, 3 and 4 should apparently be --carbazole--, --dicarbazole-- and --carbazolyl--, respectively.

The limitations imposed by the term "main" in the phrase "a main component" as recited in claim 1 are not clear. It is not clear if this language places a specific limitation on the

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minimum amount of carbazole compound that must be present in the light emitting layer and, if so, if the minimum amount is determined by weight, volume or moles.

Claim 2 recites "said iridium complex compound is tris(2-phenylpyridine)" but tris(2-phenylpyridine) *per se* is not an iridium complex compound. The examiner suggests inserting --iridium-- after the closing parenthesis.

It is not clear if the layer having a hole transport capability that must be disposed between the anode and the light emitting layer according to claim 5 can be the same layer as the hole injecting layer that is laminated in contact with the anode according to claim 1. If not, clarification is requested as to whether claim 1's recitation that the hole injecting layer is "laminated in contact with said anode" requires that the hole injecting layer be in physical contact with the anode. Claim 5 does not limit the spatial relationship between the hole injecting layer and the layer having hole transport capability.

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

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5. Claims 1-3, 5, 7 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Baldo et al. in *Appl. Phys. Lett.* 75(1), pp. 4-6 (July 5, 1999).

See the whole reference.

Baldo et al. disclose electroluminescent devices comprising an anode, a layer of 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (abbreviated  $\alpha$ -NPD), a light emitting layer comprising *fac* tris(2-phenylpyridine) iridium (abbreviated Ir(ppy)<sub>3</sub>) and 4,4'-N,N'-dicarbazole-biphenyl (abbreviated CBP), a hole blocking layer of 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (abbreviated (BCP), an electron transporting layer of tris(8-hydroxyquinoline) aluminum (abbreviated Alq<sub>3</sub>), and a cathode. Baldo et al. also disclose a similar device in which the light-emitting layer contains Alq<sub>3</sub> instead of CBP.

Ir(ppy)<sub>3</sub> is the specific iridium complex compound required by claim 2.

CBP is the specific carbazole compound required by claim 3.

Four of the six devices represented in Fig. 2 of the prior art contain Ir(ppy)<sub>3</sub> at a concentration within the range set forth in claim 1. As taught in the paragraph bridging the two columns on page 5, maximum efficiency was achieved for the Ir(ppy)<sub>3</sub>:CBP devices at an Ir(ppy)<sub>3</sub> concentration of 6-8% by weight.

The layer of  $\alpha$ -NPD in the prior art devices meets the limitation of a hole injecting layer as recited in claim 1 and a layer having a hole transport capability as recited in claim 5.

The ionization potential relationship required by claim 8 is inherent in the prior art devices which comprise a hole blocking layer. (With respect to the Ir(ppy)<sub>3</sub>:CBP devices, it is the examiner's understanding that CBP has at least a slight ability to transport electrons and

therefore considers CBP to meet the limitations of an electron transport material for purposes of claim 8. With respect to the Ir(ppy)<sub>3</sub>:Alq<sub>3</sub> devices, Alq<sub>3</sub> is an electron transport material and meets the limitations of claim 8.)

6. Claims 1-3 and 5-8 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsutsui et al. in *Jpn. J. Appl. Phys.* 38, pp. L1502-L1504 (December 15, 1999).

See the whole reference.

Tsutsui et al. disclose electroluminescent devices comprising an anode, a layer of 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (abbreviated  $\alpha$ -NPD), a light emitting layer comprising *fac* tris(2-phenylpyridine) iridium (abbreviated Ir(ppy)<sub>3</sub>) and 4,4'-N,N'-dicarbazole-biphenyl (abbreviated CBP), a hole blocking layer of 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (abbreviated (BCP), an electron transporting layer of tris(8-hydroxyquinoline) aluminum (abbreviated Alq<sub>3</sub>), a layer of Li<sub>2</sub>O and a layer of aluminum.

Ir(ppy)<sub>3</sub> is the specific iridium complex compound required by claim 2.

CBP is the specific carbazole compound required by claim 3.

Two of the three devices represented in Fig. 1 of the prior art contain Ir(ppy)<sub>3</sub> at a concentration within the range set forth in claim 1. As taught in the paragraph bridging pages L1502 and L1503, the highest quantum efficiency was achieved at an Ir(ppy)<sub>3</sub> concentration of 6.5 wt%.

The layer of  $\alpha$ -NPD in the prior art devices meets the limitation of a hole injecting layer as recited in claim 1 and a layer having a hole transport capability as recited in claim 5.

The layer of  $\text{Li}_2\text{O}$  meets the limitations of an electron injecting layer as recited in claim 6. (While the prior art refers to the combination of the  $\text{Li}_2\text{O}$  layer and the aluminum layer as the cathode, this bilayered structure is the same structure disclosed on page 25 of the present specification as an electron injecting layer and cathode.)

The ionization potential relationship required by claim 8 is inherent in the prior art devices. (It is the examiner's understanding that CBP has at least a slight ability to transport electrons and therefore considers CBP to meet the limitations of an electron transport material for purposes of claim 8.)

7. Claims 1-8 are rejected under 35 U.S.C. 102(e) as being anticipated by Hosokawa (US 2002/0045061 A1).

The cover sheet of this published application incorrectly indicates that the application was filed July 17, 2001. The application was actually filed March 26, 2001 and is thus available as prior art under 35 U.S.C. 102(e). Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

The electroluminescent device of Comparative Example 1 described on page 16, with reference to Example 1 which is described on pages 15-16 and with reference to formula (6) which is shown on page 1, meets the limitations of present claims 1-3 and 5-8.

Formula (42) on page 11 is the formula of the compound named in present claim 4. Although the reference does not disclose a specific example of a device comprising the carbazole

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compound of formula (42) in the light emitting layer, it is the examiner's position that one of ordinary skill in the art at the time of the invention could have at once envisaged a device having the layer structure described for Example 1 but utilizing the carbazole compound of formula (42) instead of the carbazole compound of formula (9) based on the teachings of the prior art that the carbazole compounds of formulae (9) and (42) can be used for the same purpose. Such a device meets the limitations of present claims 1, 2, and 4-8.

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. as applied under 35 U.S.C. 102(b) above or over Tsutsui et al. as applied under 35 U.S.C. 102(b) above, either reference further in view of JP 2000-21572.

Each of the primary references discloses a device in which the light emitting layer comprises the carbazole compound required by claim 3, but does not disclose a device in which the light emitting layer comprises the carbazole compound required by claim 4.

JP 2000-21572 discloses the carbazole compound required by claim 4 and the carbazole compound required by claim 3, and teaches that these compounds can be used in a light emitting



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layer of an electroluminescent device. See the abstract and see the compounds of formulae (1) and (23) (pages 7-8 of the Japanese language document).

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to use other known carbazole compounds in the light emitting layer of Baldo's device or Tsutsui's device. One of ordinary skill in the art would have been motivated to use other known carbazole compounds in order to provide other functional light emitting devices and, having knowledge of JP 2000-21572, would have reasonably expected that the carbazole compound required by claim 4 could be used for the same purposes as the carbazole compound of claim 3.

10. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. as applied under 35 U.S.C. 102(b) above or over Tsutsui et al. as applied under 35 U.S.C. 102(b) above, either reference further in view of Mori et al. (US 5,281,489) or applicants' admitted prior art.

Neither of the primary references discloses a device comprising separate hole injecting and hole transporting layers between the anode and the light emitting layer.

Baldo et al. do not disclose separate electron injecting and electron transporting layers between the cathode and the light emitting layer. (Tsutsui et al. disclose a device which meets the limitations of the layered structure: light emitting layer, electron transporting layer, electron injecting layer, cathode although Tsutsui et al. consider the electron injecting layer to be part of a bilayered cathode.)

The use of multiple layers having the functions of hole injecting and/or transporting, and the use of multiple layers having the functions of electron injecting and/or transporting is known in the art as demonstrated by the patent to Mori et al. (e.g. see column 28, line 63 - c. 29, l. 49) and as admitted by applicants (e.g. see the first paragraph in the description of the related art on page 1 of the present specification).

It would have been an obvious modification to one of ordinary skill in the art to modify the devices of Baldo et al. or Tsutsui et al. to include additional functional layers such as hole transporting and/or injecting layers or electron transporting and/or injecting layers which are known to be useful in electroluminescent devices as demonstrated by Mori et al. and as admitted by applicants. It would have been *prima facie* obvious to one of ordinary skill in the art to include additional functional layers in the devices of Baldo et al. or Tsutsui et al. for the purposes for which these functional layers are conventionally provided.

11. Miscellaneous:

The phrase "layer comprises of a carbasol compound" is grammatically incorrect (claim 1, line 6).

12. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure.

Adachi et al. in *Applied Physics Letters* disclose EL devices in which the light emitting layer comprises  $\text{Ir(ppy)}_3$  doped in an electron-transporting material. Adachi's devices do not

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meet the limitations of claim 8 because the only device having the layer structure required by claim 8 utilizes the same electron transporting material in the light emitting layer and in the hole blocking layer so the ionization potential of the electron transporting material in the light emitting layer must be the same as the hole blocking layer.

13. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (703) 308-4413. The examiner works a flexible schedule but can generally be reached at this number from 6:30 a.m. to 4:00 p.m. Monday, Tuesday, Thursday and Friday, and every other Wednesday from 6:30 a.m. to 3:00 p.m.

The current fax numbers for Art Unit 1774 are (703) 872-9311 for official after final faxes and (703) 872-9310 or (703) 305-5408 for all other official faxes. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (703) 872-9041.)

MRY  
09/13/02



MARIE YAMNITZKY  
PRIMARY EXAMINER

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